

Development of a New Flight Vent for the LOLA Laser Cavity

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Introduction

- The Lunar Orbiting Laser Altimeter (LOLA) will fly on the Lunar Reconnaissance Orbiter (LRO).
- The laser is based upon the one in the Mercury Laser Altimeter (MLA).
- LOLA will fly two lasers instead one in laser cavity.
- The MLA laser has a six year flight to station.

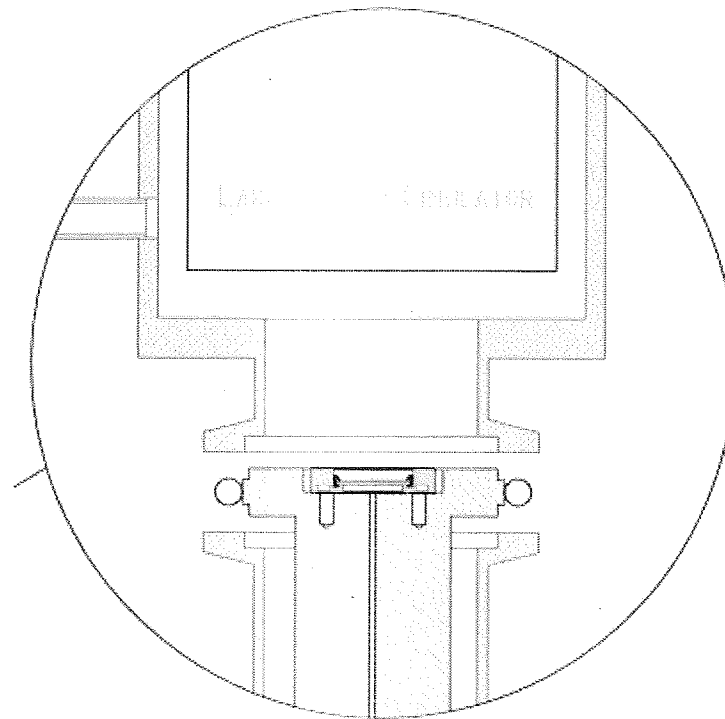
Problem Definition

- Lasers can fire in air with O₂ present.
- During testing and on orbit, LOLA will fire in vacuum.
- The laser cavity must be sealed against molecular and particulate contaminants.
- Mission to Moon will start with 60 days of launch.

Problem cont'd

- During development of mission requirements, a decision was made to re-evaluate the vent system.
- MLA system consisted of a $.5\mu$ sintered stainless steel filter, and a tiny vent tube.
- System was designed to slow the flow of contaminants into laser cavity in the event of loss of purge air.
- Models of the flow through the vent indicated that it would take weeks to ambient and raises the possibility that cross contamination between lasers exists.

Drawing of MLA Filter



Proposed Solutions

- To prevent cross contamination, put a fence between lasers.
- Clean the parts and reduce outgassing more than MLA.
- Prevent known “bad” laser materials from being used.
- Increase venting rate, add more vents, and change locations.

Solutions Chosen

- Convened expert panel.
- Eliminated changes in Be housing.
- Redesign metal filter vent hole.
- Clean NVR to $A/3$ instead of $A/2$.
- Use and RGA to ensure that bad compounds are gone - Principally: Silicones and Toluene.

Design of New Vent - Outgassing

- Insert graph of MLA venting showing long slow outgassing

Outgassing Cont'd

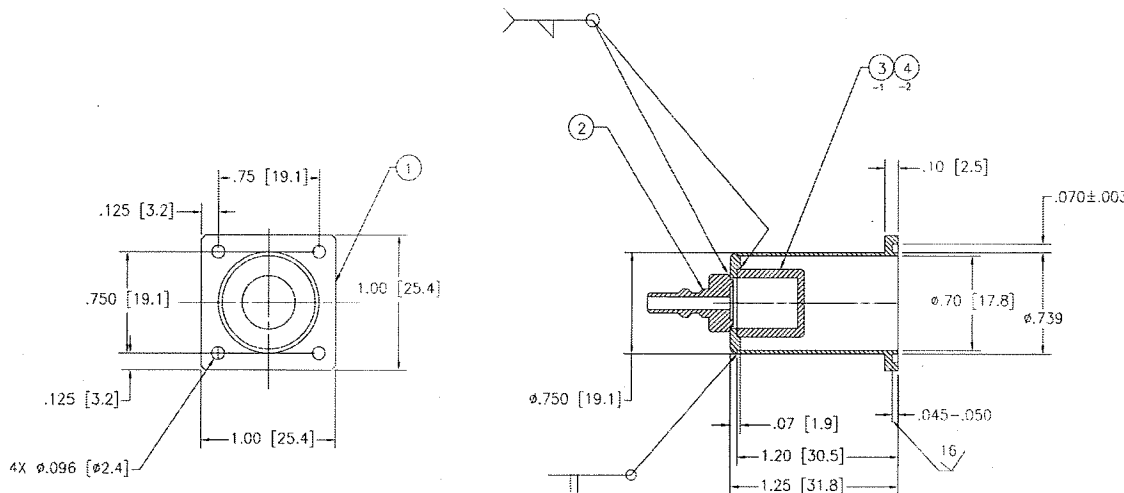
- Insert Graph of proposed changes.

New Mott design

NOTES: UNLESS OTHERWISE SPECIFIED

SOURCE OF SUPPLY:
MOTT CORPORATION
84 SPRING LANE
FARMINGTON, CT 06032
800-289-6688

REVISION				
SYM	ZONE	DESCRIPTION	DATE	APPROVAL
A		REDESIGNED: TWO PIECE FILTER CAP		
B		REDESIGN FOR FLIGHT CONFIGURATION		

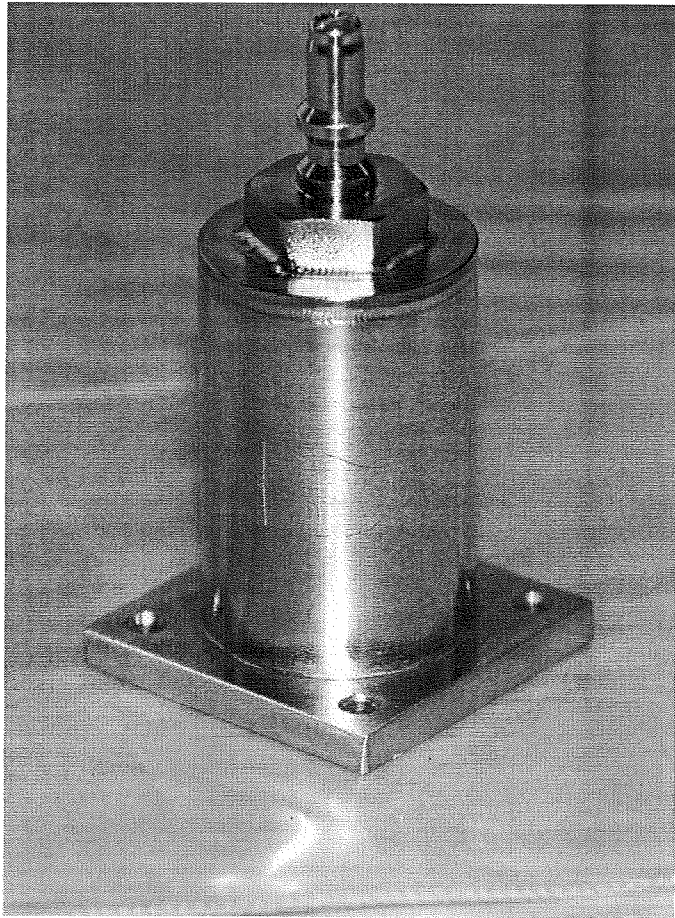


PRELIMINARY RELEASE
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INFORMATION ONLY

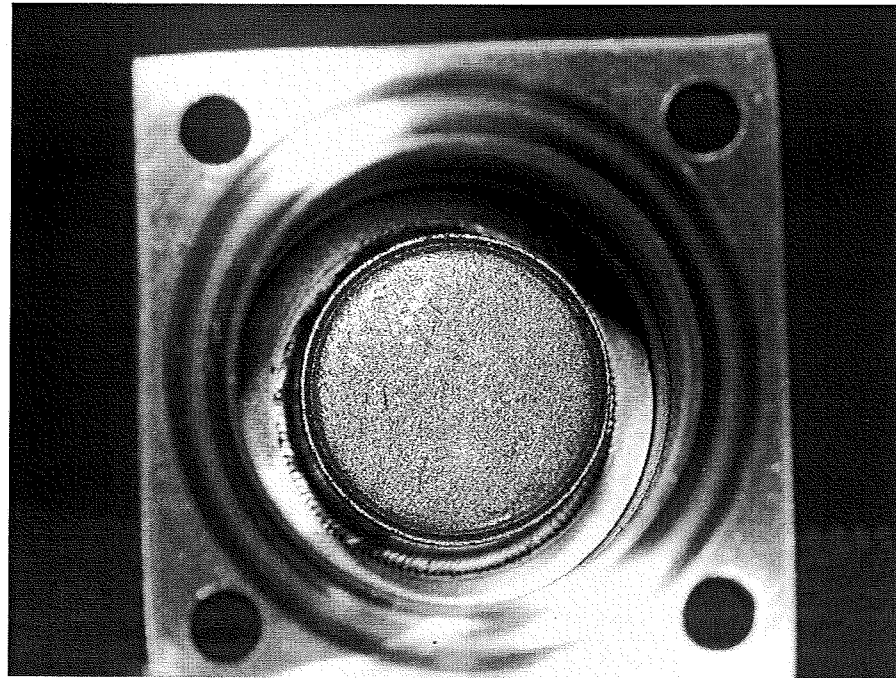
THIS DRAWING WAS PRODUCED USING
SOFTWARE: AutoCAD VERSION: 2002
FILE NAME: 2079305B

ITEM NO.	REV	PART NO.	DESCRIPTION	MATERIAL	MATERIAL SPEC.
4	1	1200-500-375-500-10	FILTER CUP, 1 MICRON MEDIA		SEE NOTE 1
3	1	1200-500-375-500-50	FILTER CUP, .50 MICRON MEDIA		SEE NOTE 1
2	1	GC2079306	FITTING, MODIFIED	CRES	
1	1	-	BAR/ROD	CRES 316	
-	-	-	WELDMENT		
LIST OF MATERIAL					
UNLESS OTHERWISE SPECIFIED-DIMENSIONS ARE IN INCHES					
TOLERANCES:					
.XX	.XXX	FRACTIONS	63		
±.01	±.005	±"	±1/16		
REMOVE ALL BURRS AND SHARP EDGES R .010 OR CHAMFER MAX					
<input type="checkbox"/> FLIGHT HARDWARE/POST FAB HARDNESS TEST REQ'D <input checked="" type="checkbox"/> HARDNESS TEST NOT REQUIRED <input type="checkbox"/> TEST HARDNESS PER ASTM E-18, LOCATION OPTIONAL <input type="checkbox"/> TEST HARDNESS PER ASTM C-18 WHERE INDICATED ON FIELD OF DRAWING THUS: O <input type="checkbox"/> NO NON-DESTRUCTIVE EXAMINATION (NDE) REQ'D <input type="checkbox"/> NDE REQUIRED PER S-313-009 CODE					
DESIGNER			INT	DATE	DRAWING INTERPRETED PER GSFC-X673-64-1
MAMAKUS					
DRAWN					TITLE
MAMAKUS					FILTER ASSEMBLY
CHECKED					WELDMENT
CUEZ					LOLA
APPROVED					
RAMSAY					
APPROVED					
MECA-DRAED					
APPROVED-STRCS					
WALL					
APPROVED-ENGINEER					
SCHWEDT					
LOLA FLI					
NEXT ASSY					
USED ON					
GC			2079305		REV B
CODE544			SCALE 2/1	WT	SHT 01 OF 1

New design Cont'd.



Flight filter profile

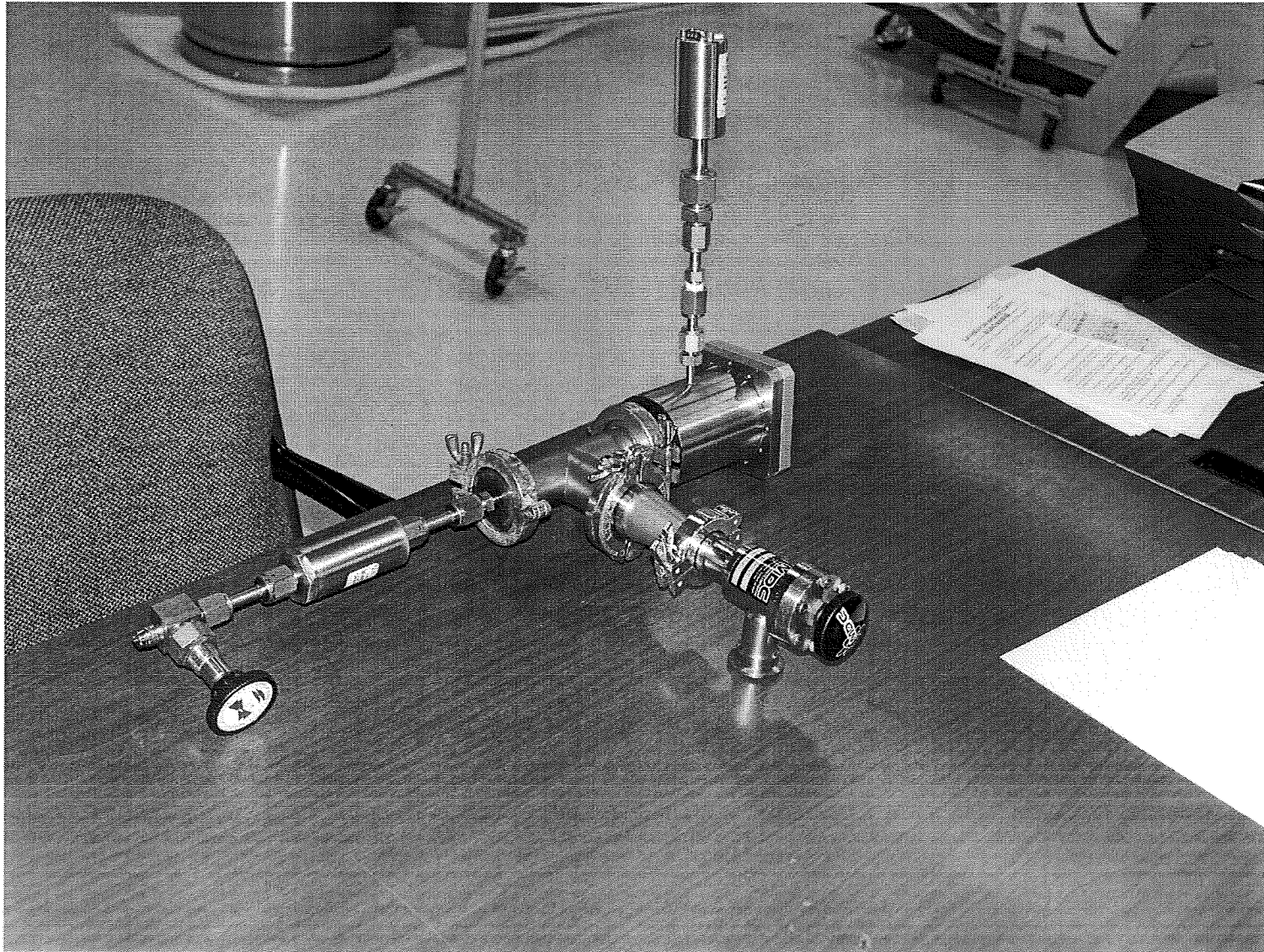


Filter base showing Mott
Sintered metal filter cup and
“O” ring cavity.

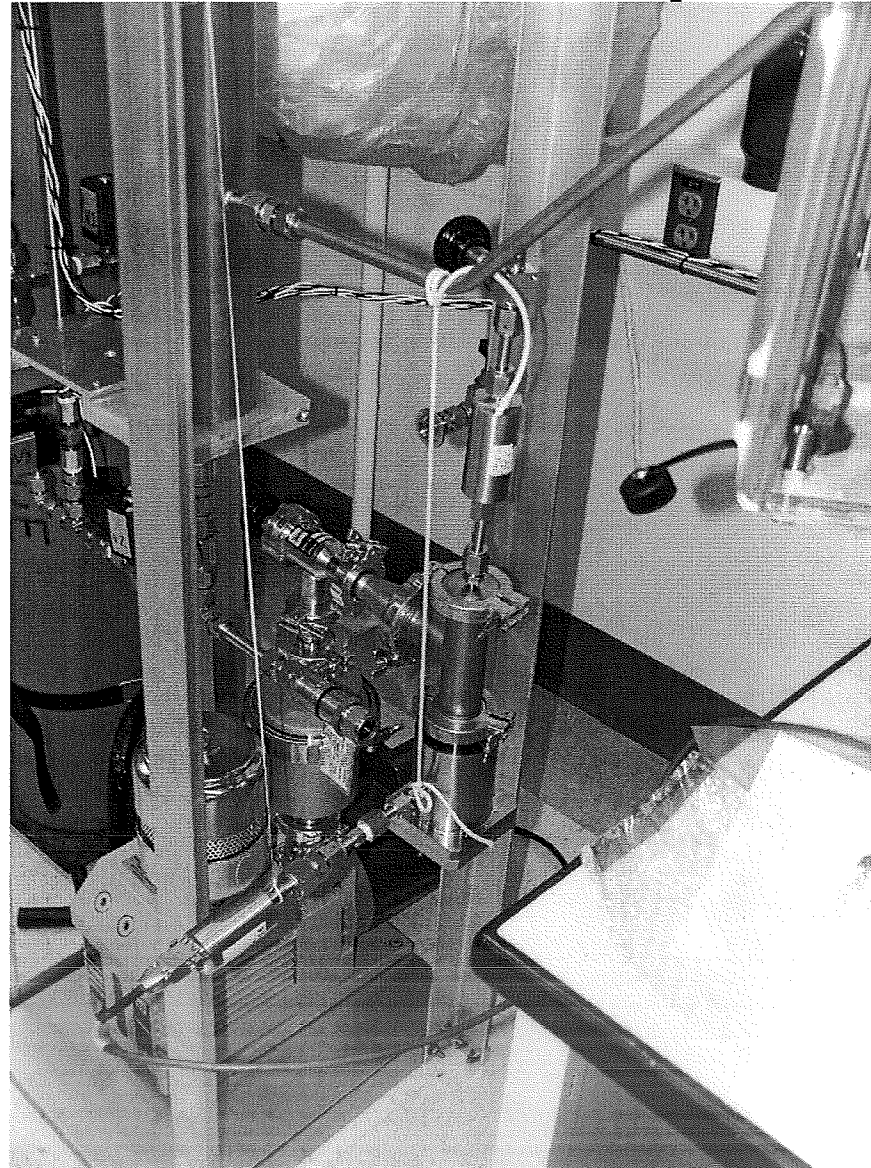
Testing New Design

- Compare outgassing rates to tests performed during MLA.
- Since MLA filters arrived clean no cleaning was necessary. Came direct from sintering furnace.
- New filters undergo machining and welding.
- Test of workmanship and cleaning technique.

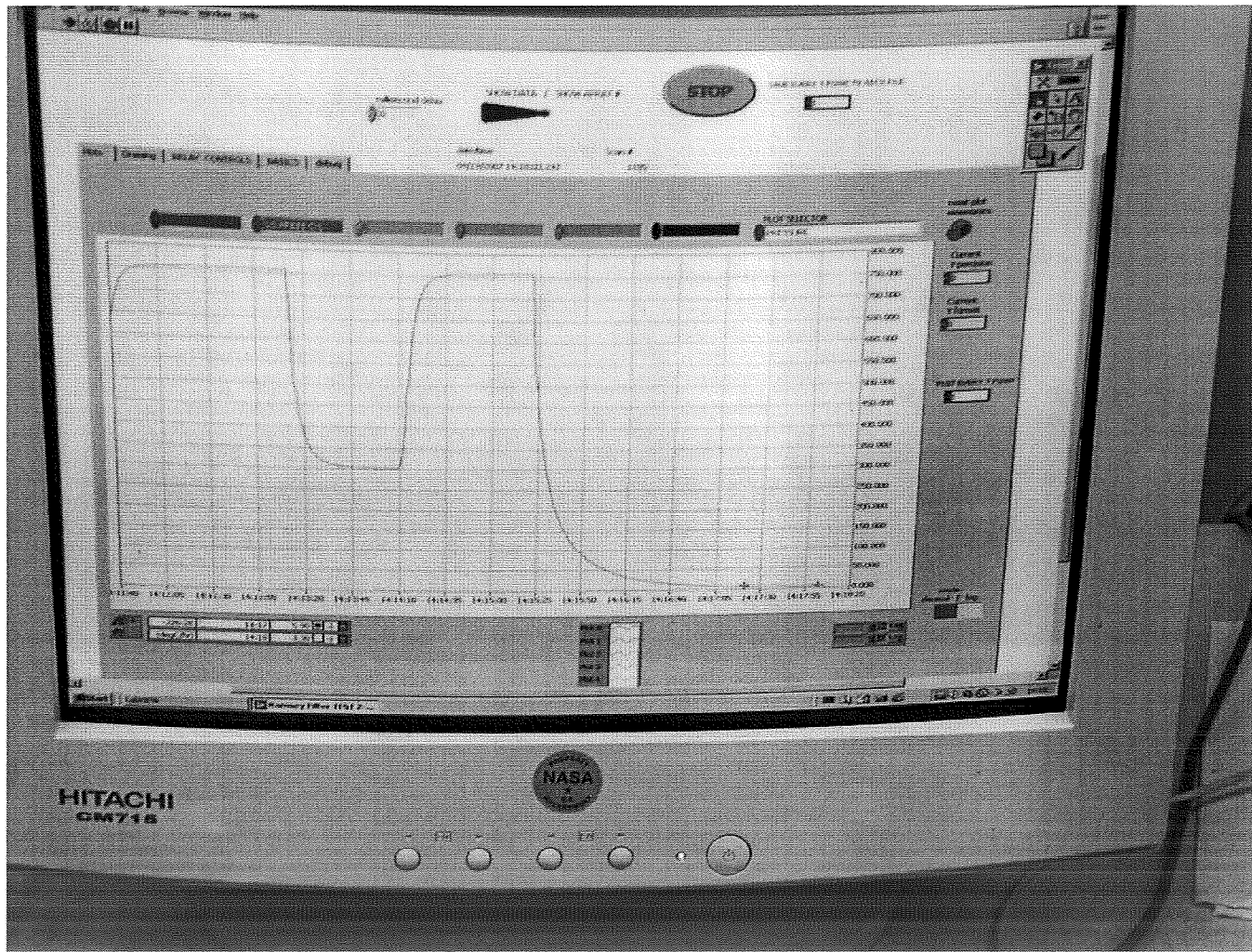
Test Setup



Test Setup

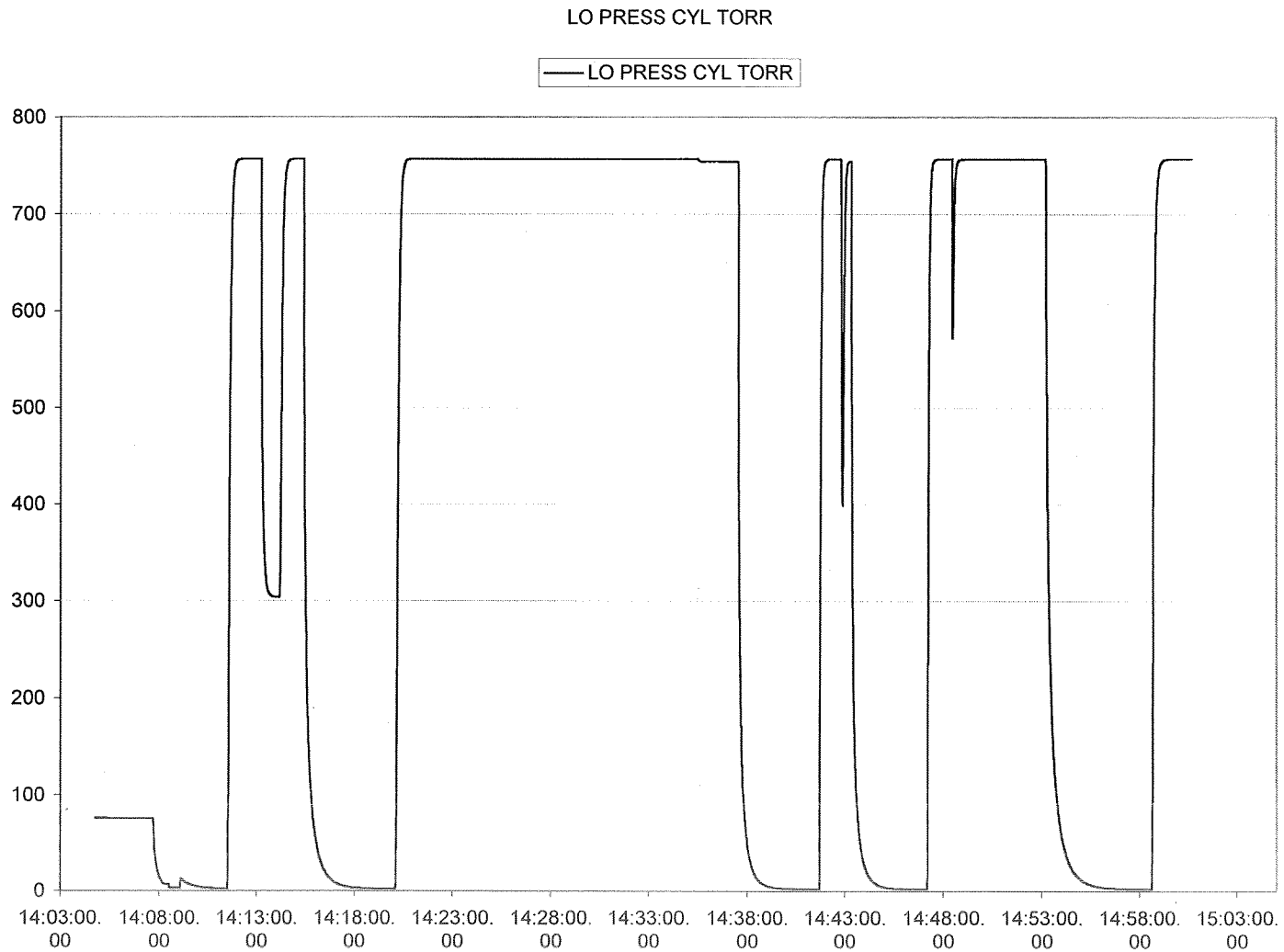


Test Setup



Insert video of test.

Test Results EM Before Cleaning



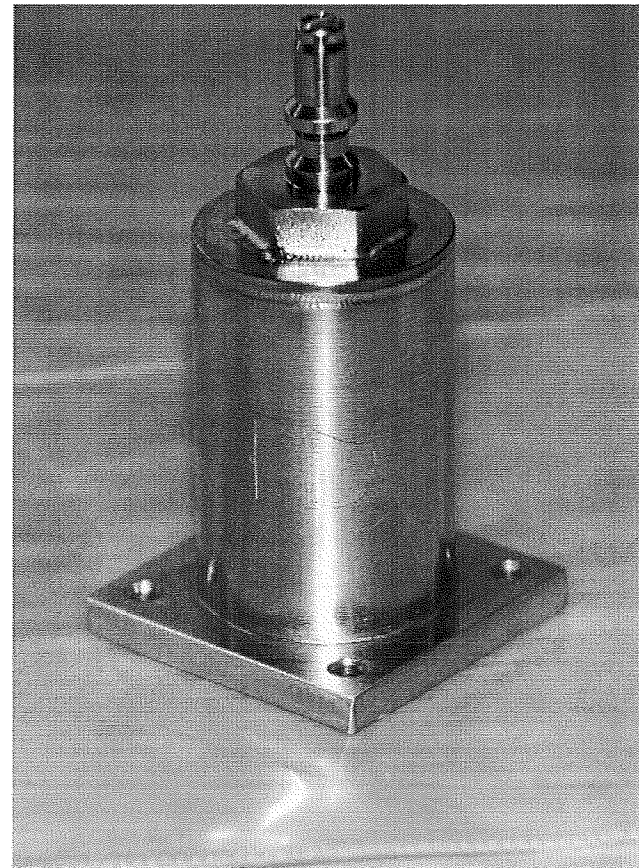
Part Cleaning

- Begin with 2% Simple Green in DI water @ 40C in ultrasonic cleaner.
- Follow with just DI. Then rinse with Isopropyl Alcohol (IPA) Dry w/N₂.
- Place part in 50:50 solution of IPA and Acetone @40C and ultrasonic cleaner.
- Rinse w/hexane take NVR sample and dry w/ N₂.
- Place in oven at 550C for 1 hour.

Test results after Cleaning

Photo of Clean Part

- Comes out a cool blue.
- No visible ash.
- No visible damage.



Ready for LOLA

